MISR Level 3 Cloud Motion Vector Product Quality Statement August 19, 2010

Authors:

Kevin Mueller

Quality Designator:

- **Stage 2 Validated:** Global Cloud Motion Vector Product

MISR maturity level definitions

This statement applies to the MISR Level 3 Cloud Motion Vector product with a version of F01_0001 or greater, effective until further improvements to MISR software or ancillary inputs are made. See the Versioning Page for an in-depth explanation of the differences between various MISR product versions. Quality statements covering earlier time periods may be accessed through links at the bottom of this page.

The evaluation of product quality is ongoing. Please read the summary words of caution if you have not done so already.

The MISR Level 3 CMV software which generated this product is believed to be functioning well except where noted below. This statement highlights major known problems with the products, as well as functionalities which are currently not implemented.

Global Cloud Motion Vector Product (a.k.a. MI3MCMVN, MI3QCMVN, MI3YCMVN) (from MISR PGE 33b) Quality Designator: Stage 2 Validated

PRODUCT MATURITY

The CMV product is designated "Stage 2 Validated."

OVERVIEW

The CMV product provides retrievals of cloud motion determined by geometrically triangulating the position and motion of cloud features observed by MISR from multiple perspectives and times during the ~7 minute overpass of the Terra platform over each cloud scene. These cloud motion vectors are produced as part of Level 2 Top-of-Atmosphere/Cloud (L2TC) Stereo product. The CMV product selects the highest quality vectors and repackages them as is (no regridding or averaging) within monthly, seasonal, and annual NetCDF files.

TERRAIN AND OROGRAPHIC CLOUD SCREENING

The L2TC product contains retrievals that reconstruct the motion of features observed in MISR images. These features may be associated with advecting clouds, orographic clouds, or terrain. The CMV product is intended to provide a proxy observation of wind, so cloud motion vectors likely to be associated with the latter two features are screened from the product. This screening is imprecise, resulting in limitations described below.

ALONG TRACK AND CROSS TRACK COMPONENTS

For reasons described in the *Level 3 Cloud Motion Vector product Algorithm Theoretical Basis Document*, MISR cloud motion vector error characteristics are closely associated with the projection of the MISR trajectory onto Earth, i.e. the sub-satellite ground track. Therefore, precision and accuracy are segmented into "along-track" components (oriented parallel to this ground track) and perpendicular "cross-track" components. At low and mid-latitudes, the along-track orientation is roughly (within 10 °) equivalent to north-south, and the cross-track orientation is roughly equivalent to east-west. Poleward of 60 °, this rough equivalence breaks down.

EXPECTED PRECISION/ACCURACY

The quality-screened cloud motion vectors within the CMV product have an empirically determined cloud altitude precision of 230 m, a cross-track cloud motion precision of 0.7 m/s, and an along-track cloud motion precision of 2.8 m/s (see *Level 3 Cloud Motion Vector product Algorithm Theoretical Basis Document*). Relative to arctic rawinsondes, the along-track cloud motion component has an RMS difference of 7.5 m/s, whereas the cross-track motion component difference is 5.5 m/s. Relative to these same observations, MISR cloud motion vectors associated with pressure levels below 700 hPa have a vector RMS difference of 5.6 m/s, whereas the difference for thes et of all MISR cloud motion vectors is 9.4 m/s. Relative to wind profiler observations over North America, MISR cloud motion vectors exhbit an RMS error of 7.3 m/s. By way of comparison, NOAA/NESDIS (GOES) atmospheric motion vectors exhibit an RMS error of 5.6 m/s relative to the Lamont wind profiler.

CMV KNOWN LIMITATIONS

The CMV product provides screened and repackaged cloud motion vectors contained within the Level 2 TC_STEREO product. Therefore, Level 2 cloud quality statement applies, including comments on image registration quality and multi-layer scenes.

Keep the following in mind when using the CMV product in scientific analyses:

1. Despite screening, a number of CMV retrievals may be associated with terrain rather than cloud, yielding a low speed bias near the surface.
2. Despite screening, a number of CMV retrievals may be associated with orographic clouds whose apparent motion is not due to advection. These cloud motion vectors are unlikely to be representative of the wind field.
3. Cloud motion due to advection may have a low speed bias relative to wind and may therefore not represent an accurate proxy in certain situations. It is difficult to imagine a situation in which a cloud moves faster than the surrounding air. In contrast, the surrounding air can clearly move faster than the cloud.
4. Motion associated with true advection of actual clouds, particularly near the surface, may be screened inappropriately, leading to a potential bias in the wind climatology in the opposite sense to (3) above. The relative contributions of these opposing effects have not been quantified.
5. The position and motion of clouds having optical depth nominally less than 0.3 or lacking distinguishable texture may not be detected by the L2TC Stereo algorithm.

References

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There are no previous versions of this quality statement.